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L2: Entry 1 of 8

File: USPT

Nov 4, 1997

US-PAT-NO: 5684370

DOCUMENT-IDENTIFIER: US 5684370 A

TITLE: Control unit and method which vary the output voltage of an AC generator based on a detected duty ratio

DATE-ISSUED: November 4, 1997

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
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US-CL-CURRENT: 318/151; 307/10.1, 315/77, 318/139

## CLAIMS:

What is claimed is:

1. A control unit for an AC generator which provides power to a battery, the AC generator having a field current running through a field coil and an output voltage adjusted by duty-controlling the field current according to a rectified output voltage of the AC generator, the control unit comprising:  
means for switching, in response to a duty ratio of the field current of the AC generator being not higher than a predetermined duty ratio, the output voltage of the AC generator to a first regulated voltage value when a lamp load is applied to the battery;

means for switching, in response to a duty ratio of the field current of the AC generator being higher than the predetermined duty ratio, the output voltage of the AC generator to a second regulated voltage value higher than the first regulated voltage value when the lamp load is applied to the battery; and  
means for switching the output voltage of the AC generator to the second regulated voltage value without regard to the duty ratio of the field current of the AC generator when the lamp load is not applied to the battery.

2. The control unit according to claim 1, wherein switching between the first regulated voltage value and the second regulated voltage value is performed by an ON/OFF signal from a lamp load switch.

3. The control unit according to claim 1, further comprising:  
means for using a second predetermined duty ratio as the predetermined duty ratio when the lamp load is applied to the battery, and using a first predetermined duty ratio as the predetermined duty ratio when the lamp load is not applied to the battery;  
wherein the first predetermined duty ratio is lower than the second predetermined duty ratio.

4. A control unit for an AC generator which provides power to a battery, the AC generator having a field current running through a field coil and an output voltage adjusted by duty-controlling the field current according to a rectified output voltage of the AC generator, the control unit comprising:  
means for switching the output voltage of the AC generator to a first regulated voltage value in response to a duty ratio of the field current being lower than a predetermined duty ratio; and  
means for switching the output voltage of the AC generator to a second regulated voltage value higher than the first regulated voltage value in response to the duty ratio being higher than the predetermined duty ratio.

5. A method for controlling an AC generator which provides power to a battery, the AC generator having a field current running through a field coil and an output voltage adjusted by duty-controlling the field current according to a rectified output voltage of the AC generator, the method comprising the steps of:

switching, in response to a duty ratio of the field current of the AC generator being not higher than a predetermined duty ratio, the output voltage of the AC generator to a first regulated voltage value when a lamp load is applied to the battery;

switching, in response to a duty ratio of the field current of the AC generator being higher than the predetermined duty ratio, the output voltage of the AC generator to a second regulated voltage value higher than the first regulated voltage value when the lamp load is applied to the battery; and  
switching the output voltage of the AC generator to the second regulated voltage value without regard to the duty ratio of the field current of the AC generator when the lamp load is not applied to the battery.

6. The method according to claim 5, wherein switching between the first regulated voltage value and the second regulated voltage value is performed by supplying an ON/OFF signal from a lamp load switch.

7. The method according to claim 5, further comprising the steps of:

using a second predetermined duty ratio as the predetermined duty ratio when the lamp load is applied to the battery; and

using a first predetermined duty ratio as the predetermined duty ratio, lower than the second predetermined duty ratio, when the lamp load is not applied to the battery.

8. A method for controlling an AC generator which provides power to a battery, the AC generator having a field current running through a field coil and an output voltage adjusted by duty-controlling the field current according to a rectified output voltage of the AC generator, the method comprising the steps of:

switching the output voltage of the AC generator to a first regulated voltage value in response to a duty ratio of the field current being lower than a predetermined duty ratio; and

switching the output voltage of the AC generator to a second regulated voltage value higher than the first regulated voltage value in response to the duty ratio being higher than the predetermined duty ratio.

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L2: Entry 4 of 8

File: USPT

Feb 2, 1993

US-PAT-NO: 5184060

DOCUMENT-IDENTIFIER: US 5184060 A

TITLE: Control apparatus for an AC generator

DATE-ISSUED: February 2, 1993

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Iwatani; Shiro	Himeji	N/A	N/A	JPX

US-CL-CURRENT: 322/99; 322/28

## CLAIMS:

What is claimed is:

1. A control apparatus for an AC generator (1) having a field coil (102) and an armature coil (101) which provides a generation signal during power generation of the generator, said control apparatus comprising:  
a rectifier (2) connected to the generator for rectifying the output voltage thereof;  
a storage battery (4) connected to the field coil of the generator for supplying a current to the field coil, said battery also being connected through said rectifier to the armature coil of the generator so as to be charged by the generator through said rectifier;  
a voltage regulator (3; 3A) connected between the generator and said battery for controlling the current supply from said battery to the field coil, said voltage regulator including a switch connected in series with the field coil of the generator for turning on and off the current supply from said storage battery to the field coil so as to control the output voltage of the generator to a predetermined value; and  
a detector (6A; 6B) connected between the armature coil of the generator and said storage battery and between said rectifier and said storage battery for detecting an operating state of the generator and operating an indicator (7) so as to indicate the detected operating state of the generator;  
said detector comprising means for preventing a significant battery leakage and discharge current flow through the detector upon the deterioration or failure of a rectifier diode, said preventing means comprising:  
an indicator switch (605, 607) for turning said indicator on and off;  
an emitter follower transistor (610) having an input terminal connected through a high impedance and the rectifier to the armature coil of the generator, and an output terminal connected to said indicator switch for controlling said indicator switch based on the generation signal from the armature coil; and  
a relatively low value capacitor (603) connected to said emitter follower transistor for smoothing the generation signal from the armature coil.
2. A control apparatus according to claim 1, wherein said indicator switch comprises a power transistor (607) which has a collector connected through said indicator to said storage battery, an emitter connected to ground and a base connected through a resistor (606) to said storage battery, and a control transistor (605) which has a collector connected to the base of said power transistor, an emitter connected to ground and a base connected through a resistor (604) to an emitter of said emitter follower transistor, said emitter follower transistor having a collector connected to said storage battery and a base connected through a reverse-current checking diode (602) and a resistor (601) to said rectifier.
3. A control apparatus according to claim 1, further comprising adjusting means

connected between said voltage regulator and said detector for detecting the output voltage of said emitter follower transistor and adjusting it to a value lower than said predetermined value to which the output voltage of the generator is controlled by said voltage regulator.

4. A control apparatus according to claim 3, wherein said voltage regulator comprises a power transistor (306) which has a collector through the field coil of the generator to said storage battery, an emitter connected to ground and a base connected through a resistor (305) to said storage battery, a first control transistor (304) which has a collector connected to the base of said power transistor, an emitter and a base connected through a first Zener diode (303) to a voltage divider (301, 302) which is connected between said storage battery and ground, and a second control transistor (311) which has a collector connected to the emitter of said first control transistor, an emitter connected to ground and a base connected through a second Zener diode (310) and a resistor (611) to the emitter of said emitter follower transistor, said second Zener diode having a threshold voltage which is lower than that of said first Zener diode.